How to Build a Silo.

HOW TO BUILD

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SILO.

WRITTEN FOR

The Farmers' Review,

By JOHN GOULD.

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ENSILAGE AND SILOS.

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The discussion of the ensilage problem, the adoption of the system by tens of thousands of farmers all over not only this country, but England, France, and other foreign countries, not omitting far-away Australia, and the overwhelming testimony in its favor wherever it has been intelligently adopted and practiced, has been a marked feature of the new agriculture of the past six years. The first few years after the announcement of its discovery, in about 1872, saw but little interest in the subject, but within the last six years—notably the years 1886-7-8—no subject has been so fraught with interest to the farmers as the matter of ensilage. And well it might. It was a new promise—a new plan of escape from the uncertainty of hay and grass crops for the maintenance of stock, and bringing in with high-priced hay the big, cheap maize crop, and with it a place of preservation novel in character, it is true, but at the same time preserving the crop in its own juices and saps, and giving the animal a food in the winter that had qualities corresponding with the standard growing foods of summer. The great, luxurious corn crop of America has in the past been scarcely more than half appreciated and not half utilized. Growing nearly 20,000,000 more acres of corn than we have head of horned cattle, we can readily see that this 60,000,000 acres and over of corn fodder plays but little part in the maintenance of our live stock, when if preserved in the silo it would supply ample roughage for our stock and leave the hay crop largely as a marketable farm product. Then in the past the science of corn growing has been but little understood, and the conditions favorable for a big and mature crop were but little better than guesswork. Now, thanks to the Farmers' Institutes, the experiment stations, and painstaking farmers,—not to forget the FARMERS' REVIEW and other live farm journals,—the growing of corn is not a matter of luck, but

can be almost depended upon as a guaranteed certainty. To this thousands of farmers in the drouth-stricken territory of the northern states can testify, who did not discard "book-learning," but cultivated and cared for their corn on demonstrated principles, and instead of being compelled to sell their stock or buy feed at high prices, put their fodder into the cheaply made silo, and had abundance, where, but a few years ago, with the then ideas of farming, destitution would have been their fortune. This same lack of knowledge in corn growing kept back the growing of corn fodder for a stock ration ; for, as usually sown, it failed to have sufficient feeding value to make it a crop worth the growing. let alone the labor involved and the enormous waste attending its wintering. Not comprehending that it is the large, lusty growing stalk of fodder that has the best and largest store of nutritious elements, the farmer, to make the stalks thin and fine, so the cutter would rapidly consume it, sowed broadcast from two and a half to four bushels of shelled corn per acre (from 80 to 128 quarts), and as a result obtained a large growth of half-developed, immature fodder that by its color did not possess even the merits of having "greenness and water," two qualities that Prof. Henry once said were the only value of a certain crop. Then by experiment and long investigation it was found that what was true of the crop of field corn was just as applicable to the crop of fodder corn—that the chief source of its food value was from the sunlight and air, and just as these two gifts of nature were disregarded, by thick planting to make shade and consequent restricted circulation of air, by just so much was the feeding value of the crop impaired. Largely through the investigation of Drs. Sturdevant and Goessemann and Prof. Henry, the feeding value of corn fodder has been made comprehensive, and something like correct data made public. The results of the experiments of these men, and others along with them, was that the value of thickly-sown corn fodder as against fodder sown in drills, using 10 to 12 quarts of seed per acre. was as about 11 to 35, while the weight of fodder on the thinly-planted field would, as a rule, equal the former. Then another fact followed—that, if the stalk was induced to grow an ear of grain and left to mature to the point of the glazing, it possessed almost equal feeding value with the ear ; in other words, the same land produced a double crop, and with but little more demand upon the soil, as the starch and sugar of the corn, its two most important feeding elements, are the gifts of the sun and not of the soil, and this much has been gained. Lastly it has been found by Dr. Goessemann that from the appearance of the tassel of the stalk to the commencement of the glazing of the ear, the fodder plant exactly doubles its feeding value,

which shows why the farmer who feeds out fodder corn just as it is tasseling out sees no benefit from it, and so condemns it as worthless without further trial or change in the method of growing it The advent of the silo found the farmer sowing corn, if at all, about three bushels of seed corn per acre, and, heeding the advice of the at that time learned ones, he was induced to make even richer the land, sow yet more corn, and try and get 90 tons of fodder per acre. This crop was cut early, rolled into the big stone silo with haste, was covered and heavily weighted down, and came out a food that, while cattle would eat it, possessed qualities that one now wonders why the whole system was not wrecked and abandoned—a matter which will be touched upon in a subsequent chapter. Gradually the plan of planting corn thinner, as shown, and for valid reasons, came to be more and more practiced, and better and better results followed, and now bed rock has been touched in the matter by drilling in from 8 to 12 quarts per acre in drills 3½ to 3¾ feet apart, dropping the grain from 5 to 6 inches apart in the rows. This gives the cornstalk room in which to grow and develop and receive the "heat and energy of the sun," and consequent food value, as no dwarfed crowded stalk can. The best known way to make the fodder corn what we would have it is to plant the best varieties about twice as thick as field corn. Plow, plant, and cultivate the same as field corn ; cultivate shallow, very, so as not to disturb the roots, for every root cut off either dwarfs the crop or delays its maturing, and at last when the stalks are developed, the ears passing out of the milky stage, then the work of filling the silo commences. Just what we shall plant for ensilage corn is a matter not fully decided. Latitude has much to do with it. The most popular variety is the "B. & W." brand of southern corn from the tide waters of Virginia, known there as "two-eared white." Its greatest value is its drouth-resisting powers, although it is unsurpassed for luxuriance of foliage and weight of fodder per acre. In the north it is not disposed to ear if planted very thickly. Not over ten quarts of seed per acre should be used of this variety if grain is wanted or expected. Its strong vitality enables it to be early planted, and by September 10 it is ready for the silo, and often with a burden of grain that is surprising. Over against this are the more lusty-growing kinds of Northern Dent corn. By some it is claimed that this latter, in the north, is the best for the silo, but the claims are in dispute. In localities where there is less than 100 days of corn weather, it is presumable that the quicker growing kinds are best, but where 120 days can be safely counted upon the southern corn will always be a favorite, if for no other reason than of its power to grow right along in dry seasons, when other corn makes but inferior growth. The ad-

vent of diversified machinery enables a farmer to do all the work of preparation, planting, and culture of corn by horse power, and so makes ensilage growing on a large scale possible and at minimum cost, and now the silo, built of wood, located where it is the most handy for economic feeding, and put up at small cost, and, what is better, a knowledge of how to put up the ensilage so it shall possess desirable qualities,—the sweet, or, a better term, ripened silage, instead of the rank acid of the past,—opens up a yet new chapter of this subject that can not fail to interest the farmer who desires a cheap and abundant ration to go with the hay, clover, and straw of the farm, and give new life as well to animal husbandry.

SILO BUILDING.

The radical changes that have taken place in silo building have had the effect of making the system more popular than any other one feature connected with it. The silo, built of stone, was at first costly, and besides involved much heavy labor and the results never were quite satisfactory, much less so when the plan of making sweet or ripened silage was brought out. The stone silo failed in doing its part, as the stone walls would prevent the silage from heating up along the sides, and then, being a good conductor of cold, frost readily entered, and complaint of more or less damaged ensilage was reported which caused Prof. Henry more than a year ago to say: "Don't build silos of stone under any circumstances, especially in cold latitudes. If you do, line up on the inside with wood to make an air space;" advice that the future will demonstrate to be sound. Then, over large areas, stone is a hard material to find, and to be obliged to build the stone silo would make them very costly, and confine their use to the more wealthy class of farmers. The substitution of wood, makes the silo a feature that every farmer can adopt, as lumber can be had anywhere, and it is being found out that the best qualities of lumber are not needed, or expensive flooring for inside ceilings, simply good fair eight-inch, or foot wide lumber, and good, sound 2x8, or 10-inch studding. Durability is given the lumber by applications of water-proof substances. Probably the cheapest and most lasting, is applications of boiling hot coal-tar, in which some resin has been dissolved to give it a solid body when cold, or a like coating of boiling pitch, both easily procured and cheaply applied. Last season many silos were built and the interior finished by lath and plastering, using cement instead of white lime for the plaster. This makes a nice silo, if the walls are solid enough to prevent springing and cracking the plaster. A few were lined up inside with brick, but the

same objection that is met with in stone walls is cncountered. The fact that about five times more fodder can be put into a silo than can be put into the same space by drying the same material has led to the building of hundreds of silos inside the barns, using part of the big bay. This saves the outside covering of the silo and the roof, the barn furnishing both. The silo usually starts from the earth, as it is sometimes difficult to get the upper floor of a barn solid enough for the foundations of a silo ; but the ground never falls through. The later ideas of silos and silo filling enable one to build the silo of far greater depth than was possible with former methods and half grown silage ; so now the wooden silo, 25 feet in depth, is no disadvantage but rather an advantage, for the greater the depth of material in the

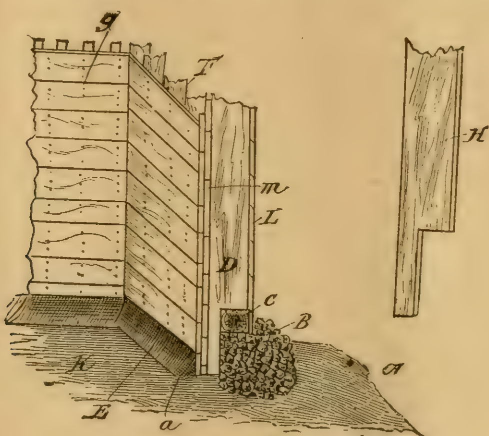

Fig. 1.

pits the greater the pressure and the better keeping merits of the silo. The chief idea to be carried out is to make the walls air-tight, and no material so good and withal cheap and effective has been discovered as two thicknesses of inch boards with a sheet of tarred paper between them, the three nailed securely to up and down studding and well painted with some sort of water proof. Nor is the timber, grout or stone floor essential. Nothing is better than clay well pounded down in the bottom of the silo, letting it come up a few inches against the inside walls of the silo so as to give the bottom or floor a slightly concave form. The sprinkling of a slight layer of straw on the bottom to prevent the silage coming in direct contact

with the clay might be indulged in, but would be more a matter of fancy than profit. The building of above ground wooden silos presupposes that due precautions have been taken against the encroachments of surface water, and this item is also in the way of better preservation of the foundation timbers of the frame. This much in a general way, and to a better understanding of the diagrams which are given, with the hopes of a clearer view of the written letter press that accompanies them Just how much a silo will cost depends

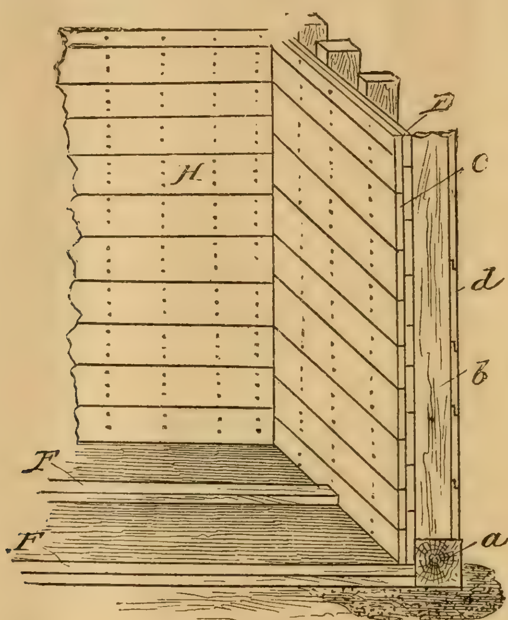

Fig. 2.

wholly upon labor, cost of material, and work of preparation, but in a general way, the silo in the barn will cost from 50 to 65 cents per ton, storage capacity, and if built outside as a separate building, with roof and the like complete, it will be somewhere from $1 to $1.50 per ton, according to the fancy of the builder.

Fig. 1 is a handy way to build when a foundation is required, as the bottom of the trench makes protection from the surface water.

M shows the two thicknesses of inch boards inside ; put on with a half width lap to prevent cracks from coming over each other. The tarred paper is between these boards, the whole firmly nailed to the studding *F*. Matched lumber is not necessary, as there are no joining cracks, and the paper makes the two practically one board. The joints should be made tight ; then, when either painted or coated with pitch all has been done that can be for making a tight wall. *E* is the clay, thrown up a few inches against the sides, which prevents the air from coming in from under the boards. *K* is the floor of the silo. The studding, *D*, is supposed to be set 16 to 18 inches apart,

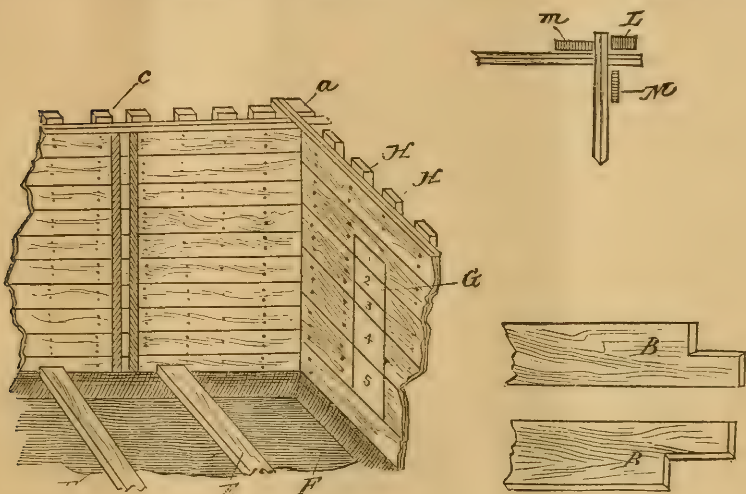

Fig. 3.

not fully shown in the diagram. *L* is the outside boarding of silo if built outside, but the inbarn silo needs no cover, as the idea of needing an absolute air space is now deemed unnecessary, as the silage is its own best protection. *H* shows how studding should be cut to fit out sill, and go down inside the wall on which to nail lining *M*. Fig. 2 shows the building of a silo without a stone foundation. The sill, *a*, is bedded into a layer of cement. *g*, the cross sills, *F*, 3 x 6 inch stuff laid flat, are morticed into the sill *a* at the lower side and cross the silo, and go into the sill opposite ; the object is to prevent the spreading of the silo, by the pressure caused by the settling silage, a

feature that is prevented by the stone wall in Fig. 1, as it is seen that the floor of the silo in Fig. 1 is fully a foot below the outside soil at *a*. Fig. 3 goes more into detail for the building of a silo to make secure corners. This is essential, for there is great strain upon the corners, and the pulling apart of the corners must be avoided. The corner *a* is made by using three scantlings, the center one, *a*, 4 x 4, and two side ones as depicted in side diagram, *L*. The first lining boards are notched at the ends, as shown at *BB*, so that they can be crossed and nailed as in *L*; they are also nailed well to *MM*. This makes a corner that cannot be pulled apart. The second lining boards are simply cut with square ends, and nailed through the paper

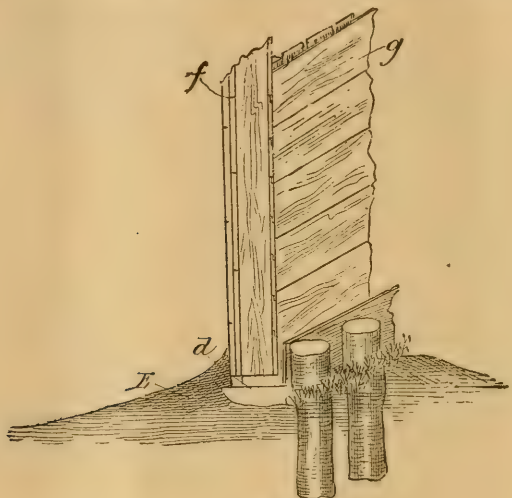

Fig. 4

and the first lining board to the scantlings *MM*. *EE* are the cross-tie sills, the same as shown in Fig. 2. *c* is a groove in walls for holding ends of partition plank, as the building of the partitions solid of 2 x 4's and double boarding is not now considered essential. Foot-wide planks with true edges held in place by grooves, as shown at *c*, the latter made of 2x4 with one corner milled down to make it three cornered, and nailed to the walls, makes a satisfactory partition, one that can be put in or removed as required in filling or feeding out the silage. *G* is the door of the silo. This is made by sawing out a doorway thirty-two inches wide and ten feet long.

Cleats are nailed up and down on the sides of studding *HH* on the outside of the lining boards. The boards 1, 2, 3 etc , are returned to their places and slightly fastened. This makes the inside wall solid again, with no "jog." When the silo is being filled, two strips of tarred paper, lapped in the center, are hung over this door on the inside. The silage pressing against it not only holds the boards in their place, but the silage against the paper pressing against the door makes the cracks air-proof. The rest of the diagram is self-explanatory. Fig. 4 illustrates a feature, detailed by a correspondent. The silo was built the same as Fig. 2, but instead of using flat cross sills to prevent spreading at the bottom, stout stub posts were set,

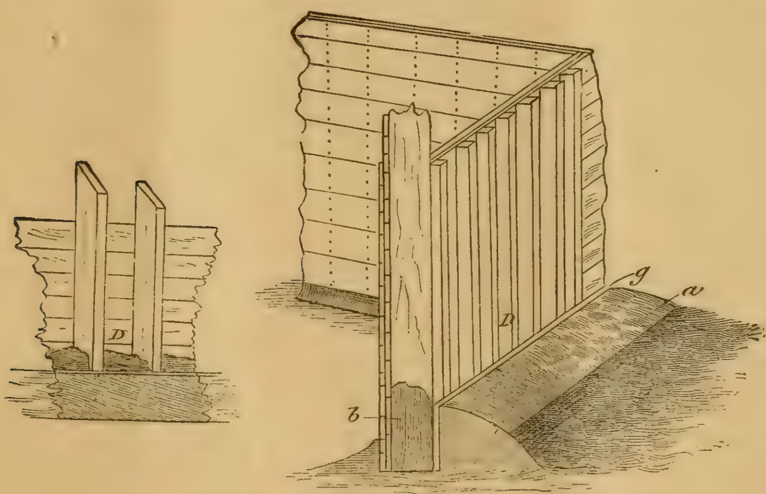

Fig. 5.

close up to the sills on the outside of the silo, and firmly tamped down. The sill was made by spiking two 10-inch planks together in *L* form, and then setting the studding inside the angle thus formed, and spiking through the plank into the studding, and saved a mortice. Fig. 5, with side diagram *D*, is yet another way of making the bottom secure, and is especially adapted to silos inside of barns, and those where the ground is "dry." It is simply excavating a cellar, one foot deep, as large as the outside measurement of the silo. A thin board, *g*, is set up against the solid dirt, the studding first painted with coal tar, then set up the same as in the other structures,

and lined up inside with the same care. The space between, the studding, *D*, is then filled in with grout, as shown at the side, Fig. *D*. This makes a solid foundation, as the board, *G*, is first removed, letting the grout come in contact with the soil, and also encases the studding and preserves it as well. The soil on the outside of the structure, *a*, can be made sloping and convey all water away from the building. Fig. 6 shows the roof frame for the building. The usual depth, 16 feet, makes the silo inclined, when filling, to spread

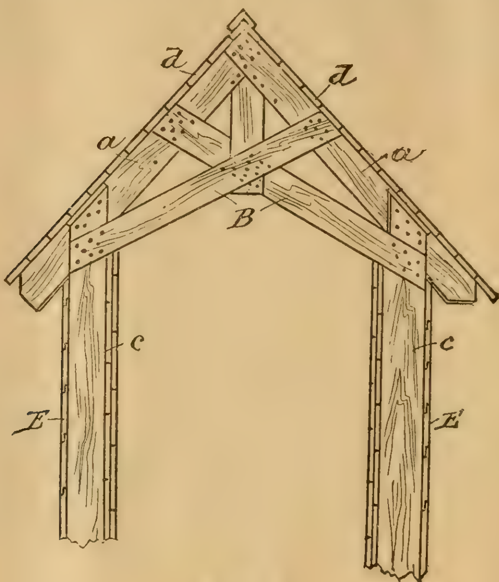

Fig. 6.

at the top, and rods and cross partitions have been adopted to prevent, but they are always in the way. This style of roof is not only self-supporting, but prevents any outward spring of the studding. As will be seen, no plate is used. The rafters, *a*, 2 x 8 inch stuff, are lapped against the stud, *c*, at the top, and well spiked with wire nails. The under braces, *B*, are 1 x 8 inch boards crossed and nailed strongly to opposite sides of the studding, from the rafters *a*, *a*. The rafters should be erected on every other one of the studding. The letter d represents the roof boarding, and *E* and *c* the inside

and outside boarding of the building. At the ends the studding should reach up to and be fastened firmly to the end rafters, and this prevents end springing of the building. As the length of the silo is twice or three times greater than the width. the end pressure is not so great in the aggregate, and this will probably be all the precaution needed at the ends.

In the silo discussion many opinions exist in regard to the amount of lumber needed for the inside lining, some contending that paper first put against the studding, with one thickness of matched flooring over it, is ample to make an air-proof wall. In some instances this has proved all right for one year, but for most service this is to be put to the test. Others failed to give perfect satisfaction, for the reason that it is almost impossible to so put the paper on to this studding so snugly but what it will "sag" away from the inside boarding and make a space between them. Then if any defect occurs in the lumber by swelling or shrinkage, there is an inlet for air to be supplied by the space made by the "sagging" of the paper This one thickness of lumber needs be very good with perfect matchings, and costs well towards the price that will be paid for the two thicknesses of common, unplaned boards, for only one surface needs to be run through the planer. It is better to have the face boards planed, as the silage settles better along a smooth wall than one with rough surface. Then the wall with two thicknesses of boards on the inside is firmer, and the silo is less liable to spring from the pressure. The outside covering may be of any cheap, fair lumber. It is a matter of protection to the building. not materially so to the silage, as a pit of silage at 85° is its own best protection against frost until the thermometer reaches to 45° below, and the freezing then will be almost wholly confined to the surface, and probably will not exceed an inch in depth, though it is rare that it will any more than "scale" over and never in above zero weather. It is better to dispense with any filling in between the studding with sawdust, tanbark or chaff to protect against frost. The filling only results in inviting the very object you are trying to guard against, and when once this filling gets damp it is a great injury to the building and had best be left out at the start and the air given free circulation between the out and inside boarding. The roof, when the frame for it is up, can be covered with shingles, but it may be possible that the new steel metal roof, that can be bought for about $3.75 per square of 100 feet, will be the cheapest in the end, as there is considerable moisture arising from the silo during the filling and during the winter, as the temperature of the silage would indicate. As to building the silo in the barn, it is a very good plan, if an ordinary 14 x 28 feet pit is wanted, but the

large silo must of necessity be an out-door structure, and, should be located to be as handy to the feeding floors as possible. The carriers of the cutters now-a-days puts the silage about where needed so the feeding out can be made all, or nearly so, "down hill" work and this economizes labor. In all silo building, but little more can be given in an article like this than a general idea that is suggestive of some plan that can be made readily adapted to the several farm wants. The usual form of the silo, is as wide as deep, and twice as long as wide. Thus a silo 28 x 14, and 16 feet deep, inside measurement, would hold 6,272 cubic feet, or 125 tons of settled silage, each 50 cubic feet, representing a ton of silage as a rule. The silo may, if possible, be built much deeper, and, as said, add value to the system. but it is not desirable to make the silo or pits less than about ten feet square and twelve deep. The dragging of the silage along the walls when settling, is greater in proportion in a small than large pit. The small silo has as many corners, and the less the contents of a pit, the less pressure by its own weight, which must be overcome by mechanical means, such as more treading and even weighting. The silo inquiries have awakened inventors, and many devices are put forth in different patterns, and possibly patents to aid in this matter, and several kinds of presses and automatic fixtures to remove or expel the air, all costing money, and more or less engineering to work them. The later idea of allowing each day's filling of the silage to heat up to 125° or about that is the most effectual method of air expelling yet found, and costs nothing and does all that is required A firm in the northwest now propose to furnish a round silo, a regular staved and hooped tank, from 10 to 16 feet in diameter, and 10, 12 and 16 feet staves. In place of a door, three "man-holes" are devised in the side, which fit close and are held secure by a cam lever. The merit of this is, that there are no corners, it can be set anywhere, can have a "loose" roof or a permanent one, can be set indoors or out; where it is the most convenient. Mr. John Carswell, near Lone Rock, Wis., has a round silo, made by standing up 2 x 4 inch scantling round a circle and lining up in the inside with two thicknesses of thin lumber that springs readily to the form required Tar paper was put between the boards, and Mr. Carswell regards it as a model silo. Just what may be in the future, in silo building is uncertain, but this is true, that every discovery has been to cheapen building and expense, and give a yet better silage, both in value and feeding results.

The filling of the silo has been made the subject of much study and experiment, and it would seem by the successes of 1887 and the scientific data ootained by Chemist Woll at the Madison, Wisconsin,

Experiment Farm, the past winter, would enable the farmer to fill his silo with reasonable expectation of obtaining a fair article of ensilage. The system of silo filling has been greatly changed in the past five years, notably so in the past two, or modified as the case best stands. The later system gives a silage practically free from acid ; especially acetic, or vinegar acid ; and in its place ripened, or sweet ensilage, is found—a food that now seems to be a fair exchange for summer rations, and not greatly, if any, inferior in feeding results. The silo of 1880 was hastily filled, with material much too thickly sown, and harvested for the silo far too early. The resulting silage was of all degrees of acidity, and of a kind to which objection was made, and probably not without cause. This hasty filling and covering with planks and paper, and vast weights of stone, etc., to expel the air, was the very agency that imprisoned a fair share of it, and the air, uniting with the juices of the corn, charged as they were with sugar, etc., ferment of a low order was invited, and, once present could not be governed, and the germs that produce acetic acid were developed. and the rank, sour ensilage of the past was the result. That this ensilage was injurious to the stock has been denied with a good show of proof. That the butter and cream from dairies fed on sour ensilage has been uniformly bad is to be doubted. That the greater part of it was superior to much that is allowed to pass "official inspection" is not denied. This left the matter to be remedied by an improvement of the system itself. Just how much loss of food value there was, is now impossible to say, but the truth is, the silo won in favor, and at last, when the process of making sweet or ripened silage was announced, the American farmer was ripe for the invention, and silos in this country and Europe have multiplied with amazing rapidity, and it is not a wild guess by any means to predict that 10,000 will be built in the United States alone, and one-fifth of this number in Wisconsin this present year. Some three years ago Professor Manly Miles announced that the acetic acid ensilage was caused by the system of silo filling itself, which produced the germ of acetic acid ferments, that this could be easily overcome by filling the silos slowly, giving each day's filling of silage time to heat up to 125 degrees and then adding another layer of fresh cut fodder, and so on ; a sweet or ripened silage would result and this heating by its own action would not cause any considerable loss of food elements ; the germs of ferment would be destroyed by this amount of heat ; that the heating and setting would expel the air and there would be no liability of the silage taking on a new active acid ferment. This was scouted at by the scientists even and laughed at generally, but the farmer had money and profits at stake rather than abstract reasoning,

and he went industriously to work, filling silos by Prof. Miles' plan, and it was a success every time when the conditions were carried out. The Professor's wisdom was vindicated, and now no one disputes the premises with him, and it is now the accepted law of silo filling to insure success. One other point, the heat and air expelling process developes a slight per cent. of carbonic acid gas, and what Prof. Miles now denominates a ripening process goes on; in one sense, a form of digestion, that partially accounts for the perfect assimilation of silage food by the animal. While this form of silage is named "sweet," it is hard to find samples but what have an acid smell, this Prof. Wall finds to proceed from a trace of lactic acid, usually less than one-half of one per cent., an amount too insignificant to be taken into account. This whole matter of Prof. Woll's chemical analysis of silage, not only from the eight state silos at Madison, Wis., but others from all over the state, is soon to be made public by the Station, and will be a valuable contribution to ensilage literature, as it will embody the investigation of nearly two years, and covers a thousand or more complete analyses. Then how shall we fill the silo to get best results? The now seeming best way is to let the corn fodder stand until fairly matured, the ears passing into the glazing stage. Two ways are in vogue in regard to cutting. The one by hand, laying the stalks in gavels, or standing them up in shocks to be taken to the silo. The other, to cut it with a stout reaper, cutting one row at a time. Both plans have their advocates, and would seem to be a matter wholly of convenience. The fodder is taken by some to the silo the same day that it is cut, others leave it 24 hours or more to wilt. This last part can be easily overdone, and the best obtainable authority would indicate the 24 hour plan best, for the best success has been with light wilting. How to draw the fodder is also susceptible of much variation. Drawing on drays; drag poles affixed to the forward wheels of a wagon using upright pins in the poles to keep the fodder from slipping down; platform racks on low wagons, the fodder being carried up at the rear on a cleated walking plank, etc., and many other plans are used, according to the inventive skill of the farmer. At the silo the ensilage cutter is placed where best suited for delivering the silage into the pits. The attached carrier of these machines makes it possible to save much labor by delivering the cut silage as near the center of the pits as possible. The cutter should be set so as to facilitate quick and handy unloading; and, if possible, without rehandling of the fodder, *i. e.*, the man who takes a bundle from the wagon should put it into the machine. In this way much labor is saved, and it is now possible for three men even to put 15 to 20 tons of silage into the pits in a day aside from the

field cutting. The best power is, of course, a four horse power engine, and the next best is a high geared-tread power, one that permits slow walking of the horses and yet maintains high speed. 500 to 600 revolutions of the knives per minute. The disposal of the silage in the pits is not a matter of so much concern or labor as was once supposed. The promotion of heat is now to be encouraged, and to this end the greater share of the tramping should be done after a layer of silage has become hot, and not before. The custom of putting horses into the pits is no longer necessary, as the heating and slow filling better does this part. The filling in by the carrier causes the silage to be highest in the center, and it should be kept only moderately level by distribution, and quite a "stack" of it should be left in the center of the pit at the conclusion of a day's cutting. In the process of heating there is no trouble about the center of the pit, but the si des and especially the corners are less acted upon, and heat developes slower by close proximity to the absorbing walls, especially so if they are of stone or cement. When heat has been developed and all is ready for the next layer, some of the silage should be forked out of the corners and the hot material from this stack in the center pitched into its place. This remedies the defect of mouldy and often sour silage found in the corners, when the balance of contents are in No. 1 order, and arises from this lack of development of heat. The usual practice of tramping frequently along the sides and especially in the corners during the day to make it settle, is to press out the air needed for the quick promoting of heat. When hot it can be readily settled down by tramping, and the settling made good by additions of silage from the central heap left for this especial purpose. This filling in every other day continues until the silo is full. The partition allows the work to go on without interruption, weather permitting, the filling of the silo being alternated. This is the whole sec et of making ripened silage: slow filling and developm nt of heat to 125 degrees or above, ten degrees more doing no hurt as far as known. Need silage fodder be cut before going into the silo? It was once supposed necessary, but the past year scores of men filled their silos with uncut fodder and report the best of success. Col. I. J. Clapp, of Kenosha, Wis., the noted Guernsey breeder, fills his silo year after year with whole fodder, and likes the plan so well that a large cutter and power stand idle by the side of the silo. The experience of Peter Pieffer, of Pewaukee, Wis., in a late *Farmers' Review*, in filing a silo with bundles of fodder, tied with two bands loosely, so they would "flatten" in laying them in position, and the excellent character of the silage when taken out of the silo, was valuable in this line. A sample of this whole silage shown by Mr. P. at

the Waukesha, Wis., Institute was most excellent. It is possible that with a limited number of cattle the plan of making silage from whole fodder will be found economic. Its only drawback seems to be in taking it from the silo, so compact and pressed together does it become. In the concluding work of silo filling a notable change has been made, that of discarding the heavy weighting of the past. The slow filling and heating has settled the silage about all that can be done ; and the air has been expelled and the n ed of the heavy planking and weighting does not longer exist. All that needs to be done now is to put on a "blanket" that will prevent the escape of the heated vapor within and prevent the entrance of air from w thout. All that is needed is to cover the surface of the leveled pit, when heated to 130 degrees, with tarred paper, and on this throw a thick layer of marsh hay, straw or the like, and a few old boards, slabs or similar material to hold the straw in place, is all the covering a silo needs, a matter fully corroborated the past season. Some discard the paper even and put on rowen, green litter or swamp hay to the depth of 18 inches, "tuck" it down along the walls with a spade, and report no spoiling of the surface, molding or souring so often found under plank and paper covers, even if weighted down with tons of stone. This is in favor of making the silage still cheaper, as the old plan called for an amount of labor on the covers that approached to one-half of the filling account. The feeding of the silage is best done continuously from the top of the silo pit, which is easily done by removing the sections of the door (seen in diagram) one at a time as occasion requires. This keeps the surface of the silage "aired" and the feeding progresses faster than any change possible in the condition of the silage. It is not a good plan to open the door to the bottom and take from the floor, as the air enters the sloping side of the exposed silage, and reheating is apt to ensue and the contents of several silos ruined, or nearly, by this procedure have been reported to me. The cover should only be taken off from one pit at a time. It is not necessary to put any temporary cover over the exposed silage while feeding it out, although in very severe weather—say 30 to 50 degrees below zero—it might be well to spread an old tarpaulin over the surface to hold the escaping heat and thus prevent the slight frosting. This embraces the essential features of silo building, filling and feeding out. The success, the profits, the praiseworthy features of the system I leave to the hundreds of readers of the *Farmers' Review* who own silos and whose testimony would be especially valuable.

[*From Farmers' Review, April 11, 1888.*]

EXPERIENCE WITH FODDER CORN AND THE SILO.

To the Farmers' Review: For the year 1887 I raised 40 acres of corn, consisting of the following varieties: B. & W. ensilage corn, 22 acres; Southern Sweet or Sheeptooth, 7 acres; Wisconsin White Dent, 7; Stowel's Evergreen Sweet corn, 4. Feeding commenced for partial soiling (pasture very poor on account of drouth) on the 27th of July; 2½ tons per day of green corn was fed to 95 cows and heifers, for 111 days, amounting to 277 tons. In September put into silo 250 tons; the balance put into shocks, 129 tons; total, 656 tons or an average of 16 tons per acre. The silo was opened December 1 and 30 pounds of ensilage per day were fed to each of the 90 cows for evening feed, or 2,700 pounds per day, until March 10—100 days—or a total of 135 tons, leaving sufficient ensilage to last to May 10. This 30 pounds of ensilage took and well filled the place of 10 pounds of hay. Had hay been fed in place of the ensilage for the night's fee l, it would have required 400 pounds per day for the 90 cows, or a totai for the 100 days of 45 tons. It would have required in 1887, 45 acres of meadow to have produced the hay, and if bought or sold would have amounted to $14 per acre. The 135 tons of ensilage were produced on 8½ acres of land, and had a feeding value as compared with hay of $74.11 per acre. The ration for each cow this winter has been as follows: Each morning feed, at 5 a. m., hay, 2 pounds per cow, after milking, dry corn fodder, 6 pounds per cow; mixed with barley straw, cut together, 2 pounds per cow; corn meal and oats mixed, 2 pounds per cow; evening feed, ensilage, 30 pounds per cow; wheat middlings, 3 pounds per cow. Two years' experience goes far to convince me that 2½ tons of ensilage made from mature sweet corn, or so far matured as to have roasting ears, is fully equal in feeding value to one ton of good hay, and is greatly to be preferred for milch cows, growing calves, brood sows and shoats. Experience confirms the opinion that the full feeding value of a nearly matured corn crop can be saved with less waste in the silo than by any other method known, and the entire expense of husking, shelling and grinding saved, while ensilage made from nearly matured corn is in better condition to go into a cow's stomach than is possible after a separation has been made by husking and grinding. Ensilage corn standing 12 to 13 feet high is difficult to shcck, impossible to stack and impracticable to put in the barn; and to leave in the field it is in the way of fall plowing, which good farming demands, and if the corn is hauled off it requires more labor than to put it into a silo. The actual cost of a corn crop put

into a silo is often greatly over estimated. The common dairy farmer has usually all the men, teams and tools required to handle a corn crop for the silo. The only legitimate charge that should be made against a corn crop that goes into the silo is wages paid to the men while doing the work. The board of the men is earned in milking night and morning, and the teams cost neither less nor more on account of the silo. What then is the actual cost of ensilage per ton or per acre, or for 40 acres? One man and team will plow 40 acres in the fall in 26 working days, wages $18 per month. Two men and two teams will in the spring cultivate and prepare the ground for planting, do the planting with horse drill, run the smoothing harrows and cultivators until June 15; wages of men, $90. Eight men will cut in the field, haul to the silo and run through the feed cutter and pack in the silo 23 tons per day, at an expense of $7.10 per day. To recapitulate, for plowing 40 acres, $18.00; planting and cultivating, $90; cutting and siloing 656 tons, $288.64; for seed, 50 cents per acre, $20; total money expense, $416.64, equal to $10.41 per acre and to 69½ cents per ton. If to this should be added use and keep of horses, $125; interest on 40 acres at $80 per acre, $192; use and wear of machinery, $25; total, $758 64. Entire cost of production, $1.15½ per ton. What, then, is the conclusion of the whole matter? Simply this, that three cows can be wintered seven months on one acre of ensilage producing 16 tons, while it required two acres of meadow in 1887 to winter one cow, with the same amount of ground feed in both cases It may justly be said that one ton of hay per acre is a light crop. It is often doubled. Sixteen tons of ensilage is not a large crop; 24 tons are often obtained. Much has been said and written in favor of putting whole corn into the silo instead of running it through the feed cutter. There is no doubt of its keeping if the air is excluded, which must be done in any case. Second crop clover mixed with the whole corn lessens the air spaces and aids the work of preservation. Many columns and pages have been written to prove that fodder corn is equally as good out of the silo as in it; that ensilage has no more nutriment than it had before going into the silo. This statement hardly settles the case. We do not put corn into the silo to gain nutriment but to preserve from waste the nourishment already in the same. Argument might be used with equal force in the case of firewood. There is no more carbon in the wood when it comes out of the woodhouse than when it went in. This whole question of the preservation of fodder corn will undoubtedly be settled the same as in the care of firewood One man hauls up his corn crop, runs it through the feed cutter, packs it in the silo away from all waste, accessible any day in the year He will be likely to

get his firewood and cut it with a buzz saw and split and pile it in the woodhouse away from all waste, accessible any day in the year. Another man will cut and shock his corn in the field, always in the way of fall plowing ; haul it in the winter from day to day as wanted. Firewood can as properly be prepared in the same way. Each man will have to settle for himself his own method of preserving fodder corn. The great advantages to be gained in raising fodder corn do not entirely depend upon the silo. The crop is a great good in itself, however preserved. Experience and observation will eventually settle—as it settles all other questions—the most economical method of its preservation. HIRAM SMITH.

[*From Farmers' Review of March 28th, 1888*]

EXPERIENCE WITH LONG ENSILAGE.

[The following communication from a well-known and influential citizen of Wisconsin will be of interest to farmers who would like to go into ensilage, but are held back on account of the expense involved in the outfit for cutting it into the silo It furnishes additional evidence that good ensilage can be made from whole length corn. Putting it into the silo bound in bundles is a new idea, but we believe a good one, as it does away with the objection to whole ensilage that it is hard to get out of the silo.—ED.]

TO THE FARMERS' REVIEW: The undersigned constructed a small silo in a cattle barn, after the plan given by Mr. John Gould a year ago, and filled it with fodder corn—using the Stowell's evergreen —when just large enough for cooking ; cut it and tied in small bundles—average height 7 to 8 feet— one day, and drew and put it in silo next day—so it was some wilted and it packed very close, same as filling a mow with bundles of grain. Always laid bundles lengthwise with wall and packed corners well. Drew in five loads the first day and got ready another cutting, and put in six loads the third day. I let it heat up to 124 degrees, and again put in six loads the fifth day. Heated up to 130 degrees, put in balance, three loads, the seventh day, and finished on the ninth day, when heat was up to 134 degrees, with two loads of second clover, quite short, all tramped or packed down well ; then covered with wheat and oats chaff, about 12 to 16 inches deep. Opened silo December 20 ; found chaff wet and soft on top, and some mouldy, about 2 to 3 inches, but dry and hot next to the clover, which came out rather black, but sweet, and cattle and horses eat it with a relish. The corn fodder was colored rather dark, and the ears well cooked, and all soft, but sweet, and

stock eat it with a relish. It proved a lighter color as we got down further, but the heat kept up well, although I took all the chaff and clover off, until it was nearly all fed out. We are so well pleased with it that we shall construct a larger silo and put up enough to keep our stock the year around, as our cows gained a large quantity in milk, and also made more and better butter as long as this silo feed lasted. Although we are feeding now well-cured dry corn fodder—cut one half inch, and bran—the cows fell off again in quantity, although the water is warmed; the preference is in favor of the silo feed. At the institute last week, in Waukesha, we were asked if the fodder could be taken out in this way as well as when cut short, and if the stalks put in the manger did not go the whole length before it was all eaten up The bundles come out as easy as when put in—they were tied with rye straw,—and the cattle eat the large end of the stalks as greedily as the tops, and soon as all had their bundle all were contented. A silo need not be so expensive as some think. Mr. John Gould's plans which he exhibits are not patented and are free for any one that wants to use them. They are about as follows: For an ordinary size, 16 feet lumber is used, common boards, nailed to a set of studding, 2x6 inches, if only 8 or 10 feet wide; 2x8 or 2x10 if 12 to 16 feet wide; fastened to a sill of same size with heavy nails, also to the plate the same way. The first layer of boards is nailed crosswise to the studding, then tarred paper is put on up and down and well lapped, then another layer of boards to cover this paper same way as first layer, only taking care to break the joints. Thus an air-tight receptacle is made. If on the outside of the barn, shingle roof, and rather common or shiplap siding are used to give it a good appearance and finish, but in the barn no roof or floor are required, only the earth should be dry and the center scooped out a little and put around in the inside to make it air tight around or under the sills. The studs should be about 20 inches apart, and in the end next the stable—always should be near it—cut out between the studding for a door to take out contents of the silo. The cut out boards will answer for the door by putting one sheet of thin paper over it and lap over the edges. The usual depth of silos is about 16 feet.

G. P. P.

Pewaukee, Wis.

[*From the Farmers' Review of April 25, 1888.*]

BEST VARIETIES OF CORN FOR ENSILAGE.

As Prof. Whitcher, Director of the New Hampshire Experiment Station, is known to have given a good deal of attention to the subject of the best varieties of corn for ensilage, with special reference to securing the largest amount of nutritive matter, a request to him for his views on the subject brought the following letter, which will be of practical interest to many readers in the west :

To the Farmers' Review : In reply to your inquiry let me say that I do most emphatically believe that there is much to be gained by a judicious selection of the variety of corn to be planted for ensilage. It will be impossible for me here in New Hampshire to tell your readers what corn is best adapted to their climate and surroundings, but I may perhaps be able to suggest a few general principles as applicable there as here. The old standard for ensilage corn was tons per acre . this covered the whole ground. Men boasted of raising 25, 30 and 35 tons per acre. Now, a ton of ensilage means what? First, it means 2,000 pounds, but this is not all it means. A certain amount of nutritive matter, and this may vary greatly in different varieties of corn raised side by side During the season of 1886 I planted the Burrill & Whitman ensilage corn and by the side of it a variety of twelve rowed flint corn, such as is used here when planting with intention of husking. The yield was 15 to 22, but while the B. & W. corn had only 18.40 per cent. of dry substance, the common flint variety had 29.45 per cent., or the twenty-two tons of B. & W. contained 80,960 pounds of dry matter, while the fifteen tons of Northern flint corn had 88,350 pounds. Now the point of this is that in New Hampshire it is useless to select a corn that is so far out of its natural climate that a respectable degree of maturity is impossible. In some other sections this same B. & W. corn might mature so far as to give as great a per cent. of dry matter as did our flint corn here. The true standard of value is not bushels per acre, but nutritive value per acre, and the true rule in selecting seed is to find some variety which, in the particular locality under consideration, will so far mature as to bring the kernel into a fully formed and solid condition that is past the liquid or "milky" stage. At this time the plant is at its best, not only in the amount of nutritive matter, but also in the quality of the dry substance. By this it will be seen that each locality must choose for itself. A corn admirably adapted for Ohio would fail in Maine or New Hampshire, not because it would not produce a large yield in tons, but because of the inferior quality of that yield. I am able to produce an ensi-

lage the nutritive ratio of which is as 11 to 7, while with the Southern or Western corn many seasons the ratio would be as 11 to 12. There is a great chance for improvement in quality of ensilage, and the greatest probability of advancement in its use is along this line.

G. H. WHITCHER.

Director N. H. Exp't Sta., Hanover, N. H.

[*From the Farmers' Review, March 7, 1888.*]

TO THE FARMERS' REVIEW: May I add a thought or two, gained from Kansas experience, to what J. B. L., of Shadeland, Ind., has said concerning ensilage, in your issue of February 22? To begin, then, cut your fodder for ensilage when the grain is in the milk (not later in this locality) and let it wilt in the field before hauling to the cutter. If you don't have a cutter that suits you, or if you have none at all, run your corn through a threshing machine with the concaves set out a little. This shreds it up in good shape for the silo or for bedding and the compost heap. Set your cutter to cut a length of stalk that is shorter than the crown of the teeth in the animals to be fed and you will not be troubled with sore gums from feeding ensilage. Cut the ensilage as slowly as you can profitably. A foot in depth per day in the silo is as much as should be cut, and a smaller quantity will do better. One man will spread it and tramp it in the silo to a sufficient density. Don't weight your ensilage; simply cover with a considerable quantity of some fine hay, like our western prairie hay if you have it. The idea that ensilage must be tramped into the silo by a horse or two and then covered air-tight with boards and weighted with a ton to the foot of surface is expensive nonsense. Don't use a stone silo unless it is lined with boards and an air space left between. Loss of heat is what spoils ensilage, and as stone is a good conductor of heat, a stone silo built entirely above ground will always be found to contain, next the walls, a foot or more of spoiled and musty ensilage. Good ensilage is "smoking hot," smells like a Kansas drug store, and never tastes sour. Your cows will tell you whether it is good or not.

Manhattan, Kans. GID.